

What is claimed is:

1. An optical signal processing apparatus based on movable tilted reflection mirror, which includes:

an optical input element;

5 an optical output element; and

a Micro-Electro-Mechanical system (MEMS) movable tilted reflection mirror unit, comprising at least a reflective mirror plane and a micro actuator connected therewith;

10 wherein the optical input element, the output element and the MEMS mirror unit are arranged to form an optical transmission path where incident light signals from the optical input element are reflected from the reflective mirror plane toward the optical output element to form a output light, and a reflected light is formed between the reflective mirror plane and the optical output element, intensity of
15 the output light is determined by the percentage of intensity of the reflected light coupled into the optical output element, and the intensity of the reflected light is controlled by the position of the reflective mirror plane that is adjustable according to a value of applied electrical load on the micro actuator.

20 2. The apparatus for optical signal processing recited in claim 1, wherein the reflective mirror plane further comprises a highly reflective thin film formed on a surface thereof.

3. The apparatus for optical signal processing recited in claim 1, wherein the optical input and output elements can be chosen from the set of optical
25 fibers and optical waveguides.

4. The apparatus for optical signal processing recited in claim 1, wherein the reflective mirror plane can be chosen from the set of a flat mirror plane, a shaped mirror plane, and a curved mirror plane.

5. The apparatus for optical signal processing recited in claim 1, wherein the
30 apparatus further comprises a control unit to provide the functions of variable optical attenuation and optical switching and the control unit can be used in the applications for communication network.

6. The apparatus for optical signal processing recited in claim 1, wherein moving directions of the reflective mirror plane actuated by the micro actuator are arbitrary directions according to a layout of the optical input element, the optical output element and the Micro-Electro-Mechanical system (MEMS) movable tilted reflection mirror unit.
7. The apparatus for optical signal processing recited in claim 1, wherein the micro actuator can be chosen from the set of MEMS electro-thermal actuators, MEMS electrostatic actuators, MEMS electromagnetic actuators, and MEMS piezoelectric actuators.
8. The apparatus for optical signal processing recited in claim 1, wherein at least one optical element is arranged on the optical transmission path to reduce unwanted optical coupling loss between different elements in the optical transmission path.
9. The apparatus for optical signal processing recited in claim 1, wherein the apparatus is arranged in an array layout for multiple channel applications of variable optical attenuator and optical switch.
10. The apparatus for optical signal processing recited in claim 1, wherein a plurality of the apparatus are integrated to form an optical signal processing apparatus with the multiple channel processing function.
11. The apparatus for optical signal processing recited in claim 1, wherein a plurality of the apparatus are integrated to form an optical signal processing apparatus with the functions of variable optical attenuation, optical switching, optical multiplexing / demultiplexing, and optical add/drop, where the reflective mirror plane is controlled by the micro actuator individually for each MEMS movable tilted reflection mirror unit of each channel of the multiple channels inside the optical signal processing apparatus.